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## RWC Music Database: Music Genre Database and Musical Instrument Sound Database

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### Abstract

This paper describes the design policy and specifications of the *RWC Music Database*, a copyright-cleared music database (DB) compiled specifically for research purposes. Shared DBs are common in other research fields and have made significant contributions to progress in those fields. The field of music information processing, however, has lacked a common DB of musical pieces or a large-scale DB of musical instrument sounds. We therefore recently constructed the *RWC Music Database* comprising four original component DBs: *Popular Music Database* (100 pieces), *Royalty-Free Music Database* (15 pieces), *Classical Music Database* (50 pieces), and *Jazz Music Database* (50 pieces). In this paper we report the construction of two additional component DBs: *Music Genre Database* (100 pieces) and *Musical Instrument Sound Database* (50 instruments). It is our hope that our DB will make a significant contribution to future advances in the field of music information processing.

## 1 Introduction

With the aim of promoting further advances in the field of music information processing, we constructed a copyright-cleared music DB that can be used in common by researchers (Goto et al., 2002). This common DB will provide a benchmark enabling researchers to compare and evaluate their various systems and methods against a common standard. It can also be used to stimulate research in corpus-oriented approaches that use statistical methods and learning techniques. In all cases, researchers can use this copyright-cleared DB for research publications and presentations (including publications in conference CD-ROMs). Since copyright restrictions prevent commercially distributed musical pieces from being easily used in such presentations, the availability of a common DB should play an important role in promoting substantial advances in this research field.

Various commonly available DBs have been built in other research fields such as speech and image processing since the importance and significance of such DBs have been widely recognized. The field of music information processing, however, has

long lacked a copyright-cleared DB of musical pieces that could be used as a common foundation for research. We therefore recently constructed a music DB — the *RWC (Real World Computing) Music Database* (Goto et al., 2002) — that researchers can obtain and use freely in common for research purposes. This music DB features four component DBs: the *Popular Music Database*, *Royalty-Free Music Database*, *Classical Music Database*, and *Jazz Music Database*. Meanwhile, for musical instrument sounds, there are the McGill University Master Samples (Opolko and Wapnick, 1987) and the University of Iowa Musical Instrument Samples released for public use, and private collections assembled within companies (Kashino and Murase, 1999). Nevertheless, there is still a need for a large-scale common DB containing the sounds of many musical instruments played in various styles.

In this paper we report the construction of two additional component DBs, *Music Genre Database* and *Musical Instrument Sound Database*, that follow the basic concept of the four DBs already used in the *RWC Music Database*. The following sections describe the design policy and an overview of each of the two new DBs.

## 2 Design Policy

We decided to include musical instrument sounds as well as musical pieces and took into consideration the following points when designing these two additional DBs.

- Content

With respect to musical pieces, we constructed a DB of music genres complementing the four DBs already in the *RWC Music Database*. This *Music Genre Database* contains 100 musical pieces in a variety of genres. In producing these pieces, we included as much variety as our production resource constraints allowed.

With respect to musical instrument sounds, we constructed a DB covering 50 musical instruments and, for each instrument, recorded individual sounds at half-tone intervals. Furthermore, to provide variety in playing style, dynamics (stress), instrument manufacturers, and musicians, we made many recordings for each type of instrument.

- Copyrights of musical pieces

To make our DB available to researchers around the world, we had to obtain all the necessary copyrights and associated legal interests related to this DB. Accordingly, for some music genres (classical, marches, vocals, and some traditional Japanese music) we used 27 public-domain pieces, and for

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Table 1: List of music CDs and DVD-ROMs for distributing the Music Genre Database and Musical Instrument Sound Database.

Content (Version)	Quantity	CD/DVD Catalog Number	Piece/Instrument Nos.
Music <u>Genre</u> Database (Original Version: <u>Mixed</u> )	9 CDs	RWC-MDB-G-2001-M01 ~ M09	Nos. 1–100
Musical <u>Instrument</u> Sound Database ( <u>Wave</u> Files)	12 DVDs	RWC-MDB-I-2001-W01 ~ W12	Nos. 01–50

Catalog number: RWC-MDB-[Content]-[Year]-[Version][Volume No.], Content: The underlined letter, Year: Made in 2001

the others we used original pieces composed and arranged for this DB. All 100 musical pieces were newly performed, sung, and recorded. Note that our DB is not copyright-free even though it is available for free for research purposes.

- Standard MIDI files (SMFs) and lyrics text files  
We prepared transcribed SMFs for all musical pieces. These SMFs are valuable because they can be freely used for research purposes and can also be used as effective substitutes for scores. Song lyrics are provided as separate text files.

Table 1 lists the music compact discs (CDs) and DVD-ROMs we prepared for distributing audio signals to researchers. Each of the musical pieces and musical instruments has a unique “piece/instrument number” (sequential within each DB) that should be referred to for research use and publication (e.g., RWC-MDB-G-2001 No. 53).

### 3 Music Genre Database

This DB consists of 100 musical pieces, three for each of 33 genres and one for a cappella. It is divided into 10 main categories (popular, rock, dance, jazz, Latin, classical, marches, world, vocals, and traditional Japanese music) and 33 subcategories (popular, ballads, rock, heavy metal, rap/hip-hop, house, techno, funk, soul/R&B, big band, modern Jazz, fusion, bossa nova, samba, reggae, tango, baroque, classic, romantic, modern, brass band, blues, folk, country, gospel, African, Indian, flamenco, chanson, canzone, traditional-style Japanese popular music *Enka*, Japanese folk music *Min’you*, and ancient Japanese court music *Gagaku*). Note that this does not mean to imply that all music can be categorized in this way: these categories were used simply for convenience when recording the pieces. All 100 pieces are original recordings, 73 being original compositions and 27 being existing public-domain pieces. A total of 280 people participated in their production.

### 4 Musical Instrument Sound Database

This DB covers 50 musical instruments and provides, in principle, three variations for each instrument. It thus comprises performances of about 150 instrument bodies. To provide a wide variety of sounds, we took the following approach.

- *Variations* (3 instrument manufacturers, 3 musicians): Each variation featured, in principle, an instrument from a different manufacturer played by a different musician.
- *Playing style* (instrument dependent): Within the range possible for each instrument, we recorded many playing styles.
- *Pitch* (total range): For each playing style, the musician played individual sounds at half-tone intervals over the entire range of tones that could be produced by that instrument.
- *Dynamics* (3 dynamic levels): We also recorded each playing style at three levels of dynamics (forte, mezzo, piano) spanning the total range of the instrument.

In producing RWC-MDB-I-2001 No. 01 “Piano”, for example, we used three pianos from three different manufacturers (Yamaha, Bösendorfer, and Steinway) and recorded, for each of 88 keys, four different playing styles (normal, staccato, pedal, and repeated playing of same sound) at three dynamic levels (forte, mezzo, and piano). In other words, we recorded a total of 3168 ( $3 \times 88 \times 4 \times 3$ ) individual sounds for this DB item. These sounds were assembled into 36 ( $3 \times 4 \times 3$ ) files, each holding 88 keys’ worth of sounds.

The sounds of these 50 instruments were recorded at 16 bit / 44.1 kHz and stored in 3544 monaural sound files having a total size of about 29.1 Gbytes and a total playback time (including mute intervals) of about 91.6 hours. Each file, in principle, holds a collection of individual sounds in the order of ascending pitch across the total range of an instrument. In addition, about five color photographs of each individual instrument were also taken and assembled into 948 files (about 703.1 Mbytes).

### 5 Conclusion

We have described the construction of the *Music Genre Database* and *Musical Instrument Sound Database* complementing the four original DBs (Goto et al., 2002) in the *RWC Music Database*. The *RWC Music Database* built in fiscal 2000 and 2001 by the RWC Music Database Sub-Working Group (chair: Masataka Goto) in the Real World Computing Partnership (RWCP) of Japan is now complete with these six component DBs. It is available to researchers around the world at a nominal cost to cover only duplication, shipping, and handling charges (i.e., it is practically free). While it was built for general purposes related to music information processing, we hope that our DB is a first step toward the construction of various music DBs for specialized purposes and will accelerate progress in this field of research.

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